**Common Core State Standards (CCSS) Mathematics Curriculum Materials Analysis Project**

**Supported by the Council of Chief State School Officers, Brookhill Foundation, and Texas Instruments**

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**Overview of the Common Core State Standards Mathematics Curriculum Analysis Project**

In June 2010, the Council of Chief State School Officers and National Governor’s Association released the Common Core State Standards for mathematics and literacy (CCSSO/NGA, 2010). By June 1, 2011, these standards had been adopted by 44 states, the District of Columbia and the US Virgin Islands. This work represents the first significant attempt in our nation’s history to systematically align common K-12 mathematics standards across the states in our nation’s history, building on previous efforts to create a national vision for mathematics education, including the National Council of Teachers of Mathematics’ standards documents (1989, 2000, 2009, 2011). As such, the new *Common Core State Standards for Mathematics* (CCSSM) will stimulate significant and immediate revisions in state mathematics assessments and classroom curriculum materials.

Predictably, some publishers already claim that their existing curriculum materials and textbooks align with CCSSM (Gerertz, 2010); however, as stated by Michael Cohen, president of Achieve, Inc., “Almost no one thinks there are solid processes in place to examine the alignment of instructional materials to state standards.” (p. 20) Over the coming years, as textbook companies revise their materials in accordance with the CCSSM, many K-12 teachers and administrators will find themselves in the position of selecting new mathematics curriculum materials. It is critical that educators have quality resources and tools to determine if the revised curriculum materials and textbooks truly align with the scope and intent of the new Standards.

To increase the likelihood that these Standards, including the both the Content Standards and Standards for Mathematical Practice, are fully implemented in mathematics classrooms across the country, school administrators and classroom teachers need immediate guidance to determine the extent to which the revised curriculum materials support implementation of the CCSSM. Given the significant changes represented in the CCSSM, it is unrealistic to expect that educators in school districts and schools have the time, resources, and background to devise independent review processes for these new standards and would require an inefficient use of local resources. To provide this guidance, the CCSS Mathematics Curriculum Analysis Project provides a set of tools to assist textbook selection committees, school administrators, and teachers in the selection of curriculum materials that support implementation of the new CCSSM.

With funding from the Brookhill Foundation and Texas Instruments and support from the Council of Chief State School Officers and National Council of Supervisors of Mathematics, a national team of educators with expertise in mathematics, mathematics education, and school administration developed a set of mathematics curriculum materials analysis tools. The team included the educators listed on the next page:

* William S. Bush (chair), Mathematics Educator, University of Louisville, Kentucky
* Diane J. Briars, Mathematics Education Consultant, Past President, National Council of Supervisors of Mathematics, Pennsylvania
* Jere Confrey, Mathematics Educator, North Carolina State University
* Kathleen Cramer, Mathematics Educator, University of Minnesota
* Carl Lee, Mathematician, University of Kentucky
* W. Gary Martin, Mathematics Educator, Auburn University, Alabama
* Michael Mays, Mathematician, West Virginia University
* Valerie Mills, Supervisor, Mathematics Education, Oakland Schools, Michigan
* Fabio Milner, Mathematician, Arizona State University
* Suzanne Mitchell, Mathematics Educator/Administrator, Executive Director of the Arkansas Science, Technology, Engineering and Mathematics (STEM) Coalition; President, National Council of Supervisors of Mathematics
* Thomas Post, Mathematics Educator, University of Minnesota
* Robert Ronau, Mathematics Educator, University of Louisville, Kentucky
* Donna Simpson Leak, Superintendent, Rich Township High School District 227, Olympia Fields, Illinois
* Marilyn Strutchens, Mathematics Educator, Auburn University; President, Association of Mathematics Teacher Educators, Alabama

**Purpose of the Project**

The purpose of the CCSS Mathematics Curriculum Analysis Project is to provide a set of tools that will assist K-12 textbook adoption committees, school administrators, and K-12 teachers in selecting mathematics curriculum materials that support implementation of the newly developed CCSSM. The tools are designed to provide educators with objective measures and information to guide their selection of mathematics curriculum materials based on evidence of the materials’ alignment with the CCSSM and support for implementation of the CCSSM in classrooms. Ultimately, the choice of which curriculum materials to adopt must be made by committees or individuals charged with that task. The intention of the tools is to provide assistance in collecting useful information focused on salient issues related to the CCSSM, to ensure consistency across reviewers, and promote discussions about newly developed mathematics curriculum materials. Therefore, at the end of the analysis, the decision about which curriculum materials to select is one that must be made based on the collective evidence gathered with the tools and the committee’s or reviewer’s vision of the need for curriculum materials to support implementation of the CCSSM locally.

CCSSM is substantially different from past national and state standards. They contain standards about content with respect to both mathematical understanding and procedural skill (CCSSM, p. 4) and Mathematical Practices that focus attention on the varieties of mathematical expertise and thinking that educators at all levels should seek to develop in their students. These Practices provide a detailed description of the way mathematics should be learned and used by students at all grade levels. The following Practices build on the Process Standards from NCTM (2000) and the strands of mathematical proficiency (National Research Council, 2001) that have been widely used in the field. These Practices describe what it means to really “do” mathematics:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Note that the Standards for Mathematical Practice are also standards and thus must be reflected in the assessments and curriculum materials that states and districts will adopt. Moreover, there are significant changes in the approach to the content, in the placement of content by grade level, and in curriculum emphasis. Thus, to ensure reliable results from the reviews of curriculum materials, the tools will be most effective if the teachers and administrators using them are well grounded in the content and in the specific language of the CCSSM. Professional development prior to the review, therefore, will be a critical component of the process. The CCSSM standards are available at <http://www.corestandards.org/the-standards/mathematics>.

**Development of the Tools**

The project team met as a group on three occasions (October 2010, January 2011, and May 2011) to develop the resources provided in this package. Three grade-band teams--K-5, 6-8, and 9-12--were formed to develop tools specific for each grade band. Three tools were developed to provide detailed information about the extent to which curriculum materials align with and support the implementation of CCSSM. Tool 1 focuses on mathematics content trajectories; Tool 2 focuses on Mathematical Practices; and Tool 3 focuses on important considerations complimentary to the standards like equity, assessment, and technology that can impact implementation of mathematics curricula. While Tool 1 is specific to a grade band, Tools 2 and 3 are general and apply to all grade bands. All three tools provide different lenses on which to base a comprehensive analysis and ultimately an informed decision.

The three tools went through various layers of development and review before being released more broadly. First, initial versions developed by the team were piloted with elementary, middle and high school mathematics teachers at three locations across the country. The tools were then revised based on these pilots. Second, the tools were sent to educators, including postsecondary mathematicians and mathematics educators and public school administrators, across the country for further review. Feedback on the tools was also obtained during sessions at the Association of State Supervisors of Mathematics (ASSM) and NCSM Annual Meetings in April 2011. The tools were revised again based on feedback from these reviewers to obtain final versions. The project team then developed a User’s Guide and a professional development experience to ensure potential reviewers used the tools as intended.

Curriculum analysis tools that describe alignment among standards and curriculum materials must consider how well both the Mathematics Content Standards and the Standards for Mathematical Practice are embedded in textbooks and curriculum materials. Tool 1 and Tool 2 were designed to analyze the “Core Curriculum” primary source materials, which generally meant the teacher’s edition and the student edition. Clearly these primary source materials should consistently align with the Core Content and Mathematical Practices. Tool 3 offers reviewers the opportunity to analyze other materials such as computer software or teaching guides that can be incorporated as integral “must use” components of the curriculum materials.

**Tool 1** provides information about the degree to which specific trajectories of mathematics topics are incorporated appropriately across grade-band curriculum materials. To make this analysis manageable and to provide an in-depth review, developers selected key mathematics domains as defined in CCSSM for each grade band. The four criteria for choosing these domains for review were: (1) they represented critical grade level mathematics content as defined by CCSSM; (2) they clearly reflected the standards at each grade band; (3) they formed content trajectories within and across content areas; and (4) they represented a shift from current curricula. Attempting to look at all mathematics standards within a grade band is overly time consuming and not realistic given the number of different curriculum materials currently available to districts and schools. By focusing more deeply on a limited number of standards in key domains, reviewers will be able to conduct in depth reviews with greater reliability in a reasonable time frame.

Tool 1 focuses on key sequences of mathematics content standards across the four grade bands: K-2, 3-5, 6-8, and 9-12 in the CCSSM. These sequences span within and across grade levels in Tool 1. This organization of the standards in Tool 1 is designed to help reviewers determine the extent to which the curriculum materials develop mathematics content across grade levels, as well as within grade levels, according to the Standards. Since CCSSM does not specify course-level standards for high school, Tool 1 for high school content contains a range of domains that would show growth across grades, depending on what curriculum pathway is being considered for high school. Also, because high school mathematics curricula may be organized in two very distinct pathways, that is, traditional course sequence (Algebra I, Geometry, and Algebra II) as well as an integrated course sequence (Mathematics 1, Mathematics 2, Mathematics 3), reviewers should consider how they will assure coherence across courses in their high school curriculum.

The Content Domains (K-8) and Conceptual Categories (9-12) that the development team selected for Tool 1 at each grade band are listed below. As mentioned above, Tool 1 does not exhaust the standards within each grade or category, but focuses on important domains or standards with within and across grades to provide a representative analysis within a reasonable time.

|  |  |  |  |
| --- | --- | --- | --- |
| **Domains** | | | **Clusters** |
| **K-2** | **3-5** | **6-8** | **9-12** |
| * Number/Operations in Base 10 * Operations and Algebraic Thinking * Geometry | * Number/Operations in Base 10 * Operations and Algebraic Thinking * Geometry * Number and Operations-Fractions | * Ratios and Proportional Relationships * Expressions and Equations * Geometry * Statistics and Probability | * Interpreting Functions * Reasoning with Equations & Inequalities * Similarity, Right Triangles and Trigonometry * Geometric Measurement and Dimension * Interpreting Categorical and Quantitative Data |

**Tool 2** focuses on the extent to which the Standards for Mathematical Practice are embedded and integrated in the curriculum materials. Since the Mathematical Practices describe the essence of “doing mathematics,” mathematics curriculum materials that align with the CCSSM must also provide teachers support in incorporating these Mathematical Practices into their lessons, thereby providing students ample opportunities to engage in the Practices.

**Tool 3** focuses on the extent to which mathematics curriculum materials address overarching considerations related to equity, assessment, and technology. This tool guides reviewers to find evidence of teacher support with regard to establishing equitable teaching practices, integrating formative assessment into teaching, and using technology to support the learning and teaching of mathematics.

The three tools developed by the team provide school administrators, teachers, and others involved in selecting mathematics curriculum materials with information to carefully analyze the materials based on important criteria and provide evidence on which to base curriculum materials adoption decisions.

The sections that follow include: a User’s Guide to assist reviewers in using the tools; grade-level versions of Tool 1, along with Tool 2 and Tool 3; and a Professional Development Guide with PowerPoint slides that can be used to prepare reviewers for using the tools reliably.

**References**

*Common Core State Standards for Mathematics* (2010). Washington, D.C.: Council of Chief State School Officers and National Governors Association.

Gewertz, C. (August 25, 2010). “Curriculum Producers Work to Reflect Common Standards.” *Education Week,* 30(1), 1, 20-21.

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**User’s Guide**

**CCSS Mathematics Curriculum Materials Analysis Project**

**June 1, 2011**

The **User’s Guide** offers specific suggestions about how to use the three curriculum analysis tools to analyze mathematics curriculum materials developed for grades K-12 with respect to the Common Core State Standards in Mathematics (CCSSM). Our experiences with curriculum analysis indicate that providing reviewers the tools and asking them to review curriculum materials is unlikely to lead to a successful analysis and selection process. Preparing the reviewers to use the tools reliably involves the following:

1. Providing professional development so that reviewers can familiarize themselves with the CCSSM and the tools;
2. Organizing teams for the work in order to analyze grade level trajectories within and across grades;
3. Using the tools in order from Tool 1 to Tool 2 to Tool 3 because Tool 2 and Tool 3 use information collected during the completion of Tool 1;
4. Providing adequate time for reviewers to conduct a thorough and in-depth reviews; and
5. Gathering teams together at the end to discuss transitions among grade levels and to use their combined evidence to make and justify recommendations regarding selection of materials.

Directions and suggestions for using each of the three tools are provided for reviewers in the User’s Guide. The tools are designed to analyze the primary source materials that describe the learning experiences in which the student will be engaged, which generally means the teacher’s edition and the student edition materials. All core curriculum materials should be used with all three tools. Other products such as computer software or teaching guides, provided that they are an integral “must use” or “will use” component of the curriculum, can be useful in responding to questions in Tool 3. The final decision should be based on evidence collected from all three tools and reflect the priorities of the school and/or district. **Throughout the process, reviewers should make independent decisions and not rely upon publisher-produced alignment guides.**

**Using Tool 1**

Too1 1 allows reviewers to analyze mathematics curriculum materials by identifying key content domains at each grade level K-8 and content clusters for high school. For grades K-8, Tool 1 also describes how the content standards can connect within and across grade levels. Tool 1 for grades K-8 was designed differently than Tool 1 for high school. The high school CCSSM addresses conceptual categories (p. 57) rather than grade bands. Furthermore, the high school content standards contain mathematics topics (denoted by +) that students should learn in order to take advanced mathematics courses such as calculus, advanced statistics or discrete mathematics (STEM standards). Reviewers should be aware of the two different content expectations of these two populations (i.e. college and career, advanced mathematics) as they review the curriculum materials.

In Tool 1, reviewers are required first to complete information about themselves and the curriculum materials under review. Below this information section are two sets of rubrics, one focused on the extent to which key mathematics content from the CCSSM is covered in the curriculum materials and one focused on the extent to which the curriculum materials include a balance of understanding and procedural skills. Overall Tool 1 includes four separate sections: (1) personal information about reviewers; (2) information gathered about the mathematics content in the curriculum materials; (3) Notes/Examples noted during the review of the curriculum materials; and (4) responses to 10 specific summary questions about the curriculum materials. The CCSSM specifies that “mathematical understanding and procedural skill are equally important and both are assessable using mathematical tasks of sufficient richness.” (p. 4). To help reviewers capture this richness in the curriculum materials, two lenses are used: coverage and balance. **Coverage** refers to the degree to which the curriculum materials attend to the content of a particular standard. The Content Coverage Rubric reports the extent to which reviewers found the designated mathematics content areas listed in Tool 1. Reviewers must decide if (1) the mathematics content area was found, (2) major, some, or a few gaps were found, or (3) the mathematics content area was covered fully. A key consideration is how easily content gaps could be filled by the district, school, or teacher. For example, it might be relatively easy to provide practice on a particular skill that might be under-emphasized. Providing lessons to address development of a concept that is not addressed may be much more difficult.

**Balance** addresses the degree to which the mathematics content is developed with a balance between mathematical understanding and procedural skill in ways that are consistent with the standard. The rubric is designed to gather specific evidence regarding how the curriculum materials capture understanding and procedural skills as intended in the CCSSM.

|  |  |
| --- | --- |
| **Content Coverage Rubric (Cont)**:  Not Found (N) - The mathematics content was not found.  Low (L) - Major gaps in the mathematics content were found.  Marginal (M) - Gaps in the mathematics content, as described in the Standards, were found and these gaps may not be easily filled.  Acceptable (A) - Few gaps in the mathematics content, as described in the Standards, were found and these gaps may be easily filled.  High (H) - The mathematics content was fully formed as described in the Standards. | **Balance of Mathematical Understanding and Procedural Skills Rubric (Bal)**:  Not Found (N) - The content was not found.  Low (L) - The content was not developed or developed superficially.  Marginal (M) - The content was found and focused primarily on procedural skills and minimally on mathematical understanding, or ignored procedural skills.  Acceptable (A) -The content was developed with a balance of mathematical understanding and procedural skills consistent with the Standards, but the connections between the two were not developed.  High (H) - The content was developed with a balance of mathematical understanding and procedural skills consistent with the Standards, and the connections between the two were developed. |

The Coverage and Balance rubrics use non-numeric scales, (i.e. Not Found, Low, Marginal, Acceptable, and High) to better capture the qualitative nature of this part of the review. We chose not to use a numerical scale for the rubrics because the categories are more appropriately used as guidance for discussions in order to make reasoned decisions about the curriculum materials rather than to compute an “average” numerical result.

Reviewers are required first to locate evidence of the Standards in the curriculum materials noting the location by page numbers in the first column labeled Chap Pages (chapter pages) beside the Standards. Reviewers are then asked to record their judgments regarding the Content Coverage and Balance Rubrics. **For this analysis, we suggest that the reviewers focus on only the teacher and student books, not any supporting materials.**Throughout the review process, reviewers should make notes of evidence that supports their judgment and write down key examples of what they found during the content analysis so that this information might be shared in subsequent group discussions about the curriculum materials.

At the end of Tool 1, reviewers are asked to respond to a set of questions under the headings *Overall Impressions*, *Content Alignment*, and *Balance between Mathematics Understanding and Procedural Skills*. These questions are designed to provide guidance for within and across grade-band discussions to determine the degree to which the key trajectories and content in the curriculum materials were developed in line with the CCSSM. Recording the final outcomes from these discussions will be useful for subsequent discussions and recommendations.

**Using Tool 2**

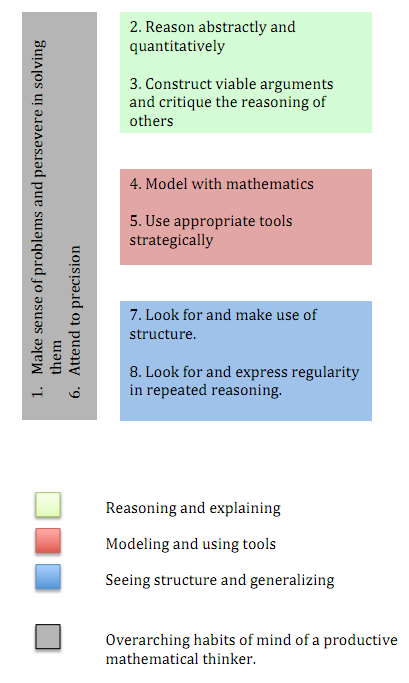


Figure 1

<http://commoncoretools.files.wordpress.com/2011/03/practices.pdf>

Tool 2 is used to determine the extent to which the curriculum materials were designed to provide students opportunities to engage in the Standards for Mathematical Practice. The CCSSM specify that “the Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important ‘processes and proficiencies’ with longstanding importance in mathematics education.” (p. 6). This tool allows reviewers to determine how well the Mathematical Practices connect to student and teacher activities in the curriculum materials.

To begin the search for Mathematical Practices in curriculum materials, reviewers are pointed to the shaded cells in Tool 1. These content standards were chosen as a basis for reviewing the Mathematical Practices because developers felt that they had the greatest potential to incorporate the Mathematical Practices in the curriculum materials.

Using the content standards in those cells as a basis, reviewers can use their notes from Tool 1 to locate those content areas in the curriculum materials and analyze specific student tasks, assignments, or projects in the materials to determine, and then to assess, the extent to which the materials reflect the eight Mathematical Practices. Reviewers should record these results in Tool 2. Keep in mind that the identified content standards are only suggestions, not mandates, for where the practices might be addressed. To ensure that reviewers do not miss important aspects of curriculum materials designed to support the Mathematical Practices, reviewers should read the overview in Practices to ascertain the ways in which the materials addresses the Mathematical Practices. Reviewers can then use this information in using Tool 2.

The evidence and notes about the location and nature of the Practices should be recorded in the boxes under each of the eight Practices to facilitate discussions among reviewers later. If no evidence can be found to support a particular Mathematical Practice, a note should be made of this as well. A copy of the Standards for Mathematical Practice, presented as a bulleted list of the ways to engage in doing mathematics for each standard, accompanies Tool 2 to assist in the review.CCSSM places great emphasis on Standards for Mathematical Practice, so reviewers should become very familiar with these Practices and what they mean in order to effectively use this tool. The Mathematical Practices in Tool 2 have been organized in one possible configuration (Figure 1); however, the Practices are not necessarily discrete and other structures may be possible. One example or task may fit under multiple Mathematical Practices and should be recorded in each.

At the end of Tool 2, reviewers are asked to respond to a set of questions to determine the degree to which the mathematics content reviewed in the curriculum materials support teachers as they engage students in the Mathematical Practices. These questions are designed to provide guidance for within and across grade-band discussions. Recording the final outcomes from these discussions would likely be useful for subsequent discussions and recommendations.

**Using Tool 3**

Tool 3 is designed to address three overarching considerations that will impact the materials’ effectiveness in supporting the CCSSM. It should be used after reviewing mathematics curriculum materials using Tool 1 (Content Analysis) and Tool 2 (Mathematics Practices Analysis). Based on what reviewers have noted in reviewing the materials, as well as in additional software or materials that have been identified by the committee as an integral “must use” or “will use” component of the curriculum, reviewers should answer the questions reflecting how well the curriculum materials support teachers with regard to the three important overarching issues of **Equity/Diversity/Access, Formative Assessment,** and **Technology** that support teaching the Mathematics Core Content and Mathematical Practices. With regard to **Equity/Diversity/Access**, the National Council of Teachers of Mathematics (NCTM,1991) asked teachers to: (1) build on how students’ linguistic, ethnic, racial, gender, and socioeconomic backgrounds influence their learning; (2) help students become aware of the role of mathematics in society and culture; (3) expose students to the contributions of various cultures to the advancement of mathematics; (4) show students how mathematics relates to other subjects; and (5) provide students with opportunities to apply mathematics to authentic contexts. CCSSM also notes that, “The Standards should be read as allowing for the widest possible range of students to participate fully from the outset, along with appropriate accommodations to ensure maximum participation of students with special education needs.” **Formative Assessment** is an instructional process that, if implemented appropriately, can improve student learning. Curriculum materials can provide a variety of levels of support for formative assessment, including extra homework exercises, classroom tests, and ongoing tasks including innovative projects and other student products. Finally, the increasing availability of **Technology** offers opportunities to use technology mindfully in ways that assist teachers in teaching mathematics and enable students to explore and deepen their understanding of mathematical concepts and procedures, as well as improving problem-solving and reasoning skills.

Tool 3 requires reviewers to focus their analysis on answering individual questions related to the extent that the curriculum materials reflect equitable practices, embed high quality and high cognitive formative assessments, and encourage the use of technology in rich and appropriate ways. Reviewers might wish to revisit the curriculum materials as they address the questions in Tool 3. After answering the questions using the rubric, reviewers should write comments regarding their rating in spaces provided on the left hand side of the Tool. The rubric is listed below:

Rubric for answering questions about **Overarching Considerations**:

|  |  |
| --- | --- |
| Not Found (NF) | The curriculum materials do not support this element. |
| Low (L) | The curriculum materials contain limited support for this element, but the support is not embedded or consistently present within and across grades. |
| Medium (M) | The curriculum materials contain support for this element, but it is not always embedded or consistently present within and across grades. |
| High (H) | The curriculum materials contain embedded support for this element so that it is consistently present within and across grades. |

The rubric describes the extent to which the materials provide teachers support in these three critical overarching considerations. **In contrast to the previous tools, we suggest here that reviewers consider supporting materials in addition to the teacher and student materials.**

At the end of Tool 3, reviewers are asked to summarize their responses through questions about the three overarching considerations. These questions were designed to provide guidance and stimulate discussion to determine the degree to which these issues were addressed in the curriculum materials. Recording the final outcomes from these discussions will be useful for subsequent discussions and recommendations.

**Reaching a Conclusion**

As mentioned earlier, these tools were designed to assist reviewers of mathematics curriculum materials in gathering information that can be used to determine the extent to which the materials provide teachers and students with the best opportunities to meet the CCSSM. The next step is to bring reviewers together and examine collectively the evidence gathered with the tools. In order to address the trajectories in the CCSSM, reviewers should collect the evidence across teams and grade bands--i.e., grades K to grade 2, grade 3 to grade 5, grade 6 to grade 8, and content areas in grades 9 to 12. Groups of reviewers are encouraged to work together to determine the strengths and weaknesses of each set of curriculum materials under review. We encourage them to identify those features that will provide teachers and students opportunities to meet the requirements of the CCSSM and prepare students for the upcoming assessments based on the CCSSM.